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Output growth in the post-compulsory education sector: the European experience

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Abstract

This paper analyses the problem of measuring the output of the education sector. It uses a combination of the index number approach with the education return methods. This allows us to take into account not only the number of students but also the labour outcomes corresponding to each type of education. As a result we obtain comprehensive measures of output based on enrolment, completion rates, expected wages, employability and labour market participation issues. We apply this approach to estimate the rates of growth of the output of the post-compulsory education sectors of 27 European countries over the period 2005-2009. The results show the importance of complementing raw educational data with labour outcome information when measuring output in this sector.

1.Introduction

Measuring the output of the education sector is a complex but unavoidable problem. The complexity is due to various reasons. Firstly, a very high proportion of education output is not sold on the market, especially in Europe where it is one of the most evident examples of public service provision. Secondly, the quality dimension of this particular output posits special difficulties to the measuring problem. In spite of all this, the importance of education for achieving a sustainable development and the amount of public resources allocated to the sector make this task unavoidable.

A recent OECD Handbook on the measurement of the volume output of education and health services was published recently (OECD 2010) supplying findings and recommendations on the measurement of education services. It draws a distinction between implicit and explicit quality adjustments of volume indicators. Implicit quality adjustment happens when products are suitably differentiated or stratified in measurement (i.e. different education levels). Implicit quality adjustments may however not always be sufficient and methods of explicit quality adjustment may be required. For this purpose, it may be necessary to invoke outcomes (e.g. test scores). The concept of "outcome" may be broader for the specific case of education, including a more comprehensive assessment of the direct and indirect economic and social benefits of education. This can be done through measurement of the impact of education on incomes, skills and well being of the population.

Actually, recognising the large differences with regard to scope, aims and output between the different levels of education, the OECD Handbook examines the measurement of input, output and outcome separately for the different levels of education, with, in fact, a distinction between the classes as defined in the International Standard Classification of Education (ISCED). For example, the use of test scores is a useful method for considering the quality aspect for compulsory education. For that level of education this type of information is available and comparable across countries (see Hanushek and Woessmann 2010). However, for post-compulsory education other options have to be considered given the lack of data on test scores. For that sector it is difficult to make reference to quality without taking into account ultimate outcomes such as future earnings due to education. For all the possible shortcomings of the human capital approach (OECD, 2010) even the OECD Handbook admits that it is "a valid alternative to other measures of education output provided there is a good empirical base for estimating current and expected returns to education". In fact, as the Handbook states, 21 OECD countries plan to implement output measures for education using outcome-based methods relying on future real earnings although at this stage results are very scarce, Scotland being an exception (Murray, 2007).

A number of empirical alternatives have been postulated to measure human capital (for a survey see Le et al. 2005): cost-based, income-based or approaches purely based on education data. Income-based measures of human capital are mainly based upon the present value of future earnings. A comprehensive application for the US can be found in Jorgenson and

Fraumeni (1989 and 1992). Mulligan and Sala-i-Martin (1997) supply a different income-based approach.

This paper builds on O'Mahony and Stevens (2009) and combines elements coming from different types of literature. This approach incorporates both implicit quality adjustments (taking into account the stratification distinguishing between different post-compulsory education levels) and explicit adjustments (taking into account outcomes such as earnings and employability). It draws on the index number literature (Jorgenson and Fraumeni 1992) and the returns to education approach literature based on Mincer equations (Mincer 1974) and the subsequent literature. The literature on the returns to education is vast, but Card (1999) is a very good and useful survey on the casual effect of education on earnings. Harmon et al. (2003) and Heckman et al. (2006) are comprehensive surveys on this topic from a microeconomic point of view while Sianesi and Van Reenen (2003) is a detailed survey of the literature from a macroeconomic perspective.

The result is a combined index number-econometric approach based on purely education variables such as student numbers and completion rates by education level, but also data on earnings, employment probabilities and participation rates coming from rich microdata sets such as Labour Force Surveys and Earnings Surveys.

Section 2 of this paper discusses the methodological aspects of the approach and specifies its main characteristics and advantages. Section 3 outlines the data and econometric techniques used and presents the main econometric results. Section 4 is devoted to the description, analysis and discussion of the estimates obtained for the rates of growth of the output of the post-compulsory education sector. Section 5 concludes.

2. Methodology

The methodology used in this study follows the method proposed in O'Mahony & Stevens (2009) to measure the output growth of the education sector from the evolution of the number of students in different academic levels and outcomes for the different degrees in the job market. These outcomes do not take into account private benefits from education beyond the impact on wages such as its effect on the value of leisure for individuals. Measuring this type of benefit is very difficult and controversial to some extent. Any external benefits from educational services such as fostering democracy, reducing criminality and so on are not considered either. External benefits are not usually included in measuring productivity (we follow here the national accounts convention). Finally, we focus on the human capital output of the education sector. Research activities and the provision of hospitality and similar activities are not taken into account although their role can be quite significant for some universities (Pastor, Serrano and Zaera 2012). Therefore, we focus on the output of the post-compulsory education sector which has to do with the human capital obtained by students through increasing schooling.

This method combines the index number approach with the returns to education literature. A measure of the growth in the aggregate output of the post-compulsory education sector, denoted by *Y*, can be obtained as:

$$\ln(Y_t/Y_{t-1}) = \sum_i \bar{\alpha}_i(t, t-1)\ln(E_{it}/E_{i,t-1}) \quad [1]$$

where E_{it} is the number of students enrolled in period *t* at a certain post-compulsory level *i*, and the weight $\alpha_i(t)$ is the share of the value of "notional" annual earnings of type i pupils in the total value of potential earnings outcomes for all students enrolled in post-compulsory education:

$$\alpha_i(t) = \frac{o_{it}E_{it}}{\sum_i o_{it}E_{it}} \quad [2]$$

where o_{it} denotes the impact of one additional year of education services received at level *i* on labour outcomes and $\bar{\alpha}_i(t, t-1)$ denotes averages across t and t-1.

This approach has clear similarities with the growth accounting technique. In both cases we try to estimate the rate of growth of an output when we do not know the precise aggregator (e.g. of outputs as in the present study) but have information on relative "rental prices". In order to get adequate shares we need to use an appropriate measure of outcome, o_{it}.

The particular outcome for one additional year of schooling at each level of post-compulsory education is estimated through the effect of the incremental contribution of the educational service that it provides to outcomes, other influences apart from education constant.

The first step is to estimate the earnings of persons with education level i after adjusting for the impact of experience and other control variables, denoted by I_{it}. Then the outcome for each post-compulsory level, φ_{it}, is obtained as the differential earnings of persons with that education compared to the earnings of those with the previous lower level of education, *i-1*.

$$\varphi_{it} = \left(I_{it} - I_{(i-1)t}\right) \quad [3]$$

However, we are interested in the outcome for one additional year of schooling. Qualifications take a number of years to be obtained. The annual outcome is then obtained assuming that each of the *n* years needed to complete level *i* contributes equally to the final outcome, $\frac{\varphi_{it}}{n}$.

Furthermore, we need to take into account the probability that a student enrolled at level *i* has of acquiring the qualification *i*. Therefore we may need to adjust our estimates according to the completion rates at different levels of education.

$$o_{i,t} = p_{i,t}^{g}\frac{\varphi_{it}^{g}}{n} + (1 - p_{i,t}^{g})\frac{\varphi_{it}^{ng}}{n} \quad [4]$$

Where superindex *g* denotes successful graduation at level *i*, superindex *ng* denotes lack of completion of level *i*, *n* denotes the number of years needed in theory to finish level *i* and p_{it} is the probability that a student completes level *i*.

There are different possibilities for I_{it} when considering the earnings of persons with education level *i* after adjusting for the impact of experience and other control variables. We can use either the specific wage effect for employed people, but we can consider also other labour market effects of education related to employability and participation. In general terms:

$$I_{it} - I_{(i-1),t} = \beta_{it}Pr_{it}(emp) + 0 \times [1 - Pr_{it}(emp)] \quad [5]$$

Where, according to each possibility, Pr_{it} *(emp)* denotes the probability of employment for people of working age (affected by the probability of participating in the labour market and unemployment also) or is just one if we do not want to take account of those labour market issues. The term β_i refers to the incremental wage related to level *i* education. As we will see, it comes from estimating wage equations to control for non-education factors.

If we do not take into account the probability of participating or being unemployed we are measuring the potential social outcome coming from education. It is an estimation of the potential outcome of level *i* education if every person with this level wants to participate and gets a job and depends only on wages.

If we use the probability of employment for people of working age we consider both the individual's willingness to participate or not in the labour market and the issue of unemployment. This depends on both wages (productivity issues) and employability (broader labour market issues apart from productivity). It is an estimation of the expected outcome for society taking into account that not every graduate will actually be an active agent in the labour market eventually producing marketed goods and services and that not all of those willing will be always continuously employed.

These two options generate two different alternatives for measuring the output of the education sector. Each of them is more or less appropriate according to which is the main interest of the user of the estimates.

Furthermore we need to take into account the possibility of different outcomes accruing to a year of schooling at a particular level of education *i* depending on the degree of success in completing that level. The value of $\frac{\varphi_{it}}{n}$ may well be higher for graduates than for non-graduates. In order to take into account this issue we will consider three different cases under three different assumptions:

Extreme case 1: each level of education only generates output if the student completes it successfully.

Intermediate case: each year of schooling which does not contribute to a successful graduation represents only half of that in the case of a graduate.

Extreme case 2: each year of schooling generates always the same output (in other words, successful graduation does not matter).

It should be noticed that the extreme cases 1 and 2 are the outward bounds for the actual situation. The more important we consider actual graduation to be, the closer output will be to extreme case 1 estimates. The more important we consider attendance to school irrespectively to graduation, the closer output will be to extreme case 1.

This issue is still an open question. The literature on the returns to education is not conclusive about the magnitude of the sheepskin or credential effects associated with completing key phases of education. Sheepskin effects refer to monetary returns associated with completion of a degree or diploma after controlling for education inputs such as years of schooling (Hungerford and Solon, 1987). There are some papers which analyse empirically this effect for

a number of developed countries including both years of education and credentials in the estimation of wage equations (e.g., Bauer et al., 2005 for Japan; Bol et al., 2011 for 15 European countries; Flores-Lagunes and Light, 2007 and Jaeger and Page, 1996 for the U.S.; Ferrer and Riddell, 2002 for Canada; Gibson, 2000 for New Zealand; Mora 2003 and Mora & Muro, 2008 for Colombia; Pons, 2006 for Spain). For example, the results of Bauer et al. (2005) show that sheepskin effects account for as much as 50 percent of the total returns to schooling in Japan. For New Zealand Gilson (2000) finds that the returns to credentials could even exceed the returns to years of education, especially for ethnic minorities in more need of credentials as signals for the labour market. Belman and Heywood (1991), Flores-Lagunes and Light (2007), Hungerford and Solon (1987), Jaeger and Page (1996) and Park (1999) find substantial sheepskin effects of high school and college diplomas. Ferrer and Riddell (2002) using Canadian data find large sheepskin effects associated with completing key phases of education, with the sheepskin effects increasing with educational attainment. Mora & Muro (2007) find similar higher sheepskin effects for higher levels of education in Columbia. Pons (2006) finds sheepskin effects only for women but not for men in Spain. Bol and Van de Werfhorst (2011) analyse the effect of degrees on occupational status for 15 European countries. Their results show that the additional "degree" effect could be even greater than the years of schooling effect for post-compulsory education.

3. Data and econometric estimation

We analyse the output of the post-compulsory education sector in 27 European countries[1] over the period 2004-2009 (the exact period for each country depending on data availability). We distinguish two genders and two post-compulsory education levels (ISCED 3-4 and ISCED 5-6). Therefore, we consider 4 different types of output.

The data on wages for the econometric analysis come from the EU Survey on Income, Social Inclusion and Living Conditions (EU-SILC 2004-2009). The European Union Statistics on Income and Living Conditions (EU-SILC) is an instrument aiming at collecting timely and comparable cross-sectional and longitudinal multidimensional microdata on income, poverty, social exclusion and living conditions[2]. This instrument is anchored in the European Statistical System (ESS). The EU-SILC project was launched in 2003 on the basis of a 'gentleman's agreement' in six Member States (Belgium, Denmark, Greece, Ireland, Luxembourg and Austria), as well as in Norway. The starting date for the EU-SILC survey under the below-mentioned framework Regulation was 2004 for the EU-15 (with the exception of Germany, the Netherlands and the United Kingdom, which had derogations until 2005), as well as for Estonia, Norway and Iceland. The 10 new Member States with the exception of Estonia started in 2005. The survey has also been implemented in Bulgaria, Romania, Turkey and in Switzerland as from 2007. Implementation in Croatia is being discussed. EU SILC provides cross-sectional data pertaining to a given year with variables on income, poverty, social exclusion and other living conditions.

Social exclusion and housing condition information is collected at the household level while labour, education and health information is obtained for persons aged 16 and over. We only use the personal files of the EU SILC. The core of the data, income at very detailed component

[1] Norway, Iceland and all EU-27 countries except Malta and sometimes Luxembourg.
[2] The EU-SILC is the successor of the ECHP (European Community Household Panel) project (1994-2001).

level (including employee cash or near cash income, and non-cash employee income), is mainly collected at personal level but a few components are included in the household part of SILC. The EU-SILC has been established to provide data to be used for the structural indicators of social cohesion and in the context of social inclusion and pensions.

In the EU SILC, educational attainment of a person is the highest level of an educational programme the person has successfully completed. The educational classification to be used is the International Standard Classification of Education (ISCED 1997) coded according to the seven ISCED-97 categories. The basic unit of classification in ISCED-1997 is the educational programme. Educational programmes are defined "on the basis of their educational content as an array or sequence of educational activities, which are organized to accomplish a pre-determined objective or a specified set of educational tasks". ISCED-1997 provides an improved set of criteria for assigning individual programmes to 'levels' of education. The more practical steps for the coding according to ISCED-97 can be found in the following table:

Table 1: ISCED levels of education

ISCED 0	Pre-primary level of education	Initial stage of organised instruction, designed primarily to introduce very young children to a school-type environment.
ISCED 1	Primary level of education	Normally designed to give students a sound basic education in reading, writing and mathematics.
ISCED 2	Lower secondary level of education	Generally continues the basic programmes of primary level, although teaching is typically more subject-focused, often employing more specialised teachers who conduct classes in their field of specialisation.
ISCED 3	Upper secondary level of education	ISCED 3A: Programmes designed to provide direct access to ISCED 5A.
		ISCED 3B: Programmes designed to provide direct access to ISCED 5B.
		ISCED 3C: These programmes lead directly to the labour market, ISCED 4 programmes or other ISCED 3 programmes.
ISCED 4	Post-secondary non-tertiary level of education	They are often not significatnly more advanced than programmes at ISCED 3 but they serve to broaden the knowledge of participants who have already completed a programme at Level 3.
ISCED 5	First stage of tertiary education	ISCED 5A: These programmes provide the level of education required for entry into a profession with high skills requirements or an advanced research programme.
		ISCED 5B: The programme content is typically designed to prepare students to enter a particular occupation and does not prepare students for direct access to advanced research programmes.
ISCED 6	Second stage of tertiary education	It prepares recipients for faculty posts in institutions offering ISCED 5A programmes, as well as research posts in government and industry.

The expression 'level successfully completed' must be associated with obtaining a certificate or a diploma when there is a certification. In cases where there is no certification, successful completion must be associated with full attendance or acquired competences to access the upper level. When determining the highest level, both general and vocational education/training should be taken into consideration. Persons who have not completed their studies should be coded according to the highest level they have completed. Hence, we have 6 levels of educational qualification as follows:

0) Pre-primary education
1) Primary education
2) Lower secondary education
3) Upper secondary education
4) Post-secondary non tertiary education
5) First stage of tertiary education (not leading directly to an advanced research qualification); second stage of tertiary education (leading to an advanced research qualification)

We find that many countries actually have no observation in groups of the pre-primary education, primary education and post-secondary non tertiary education. Hence, when we do the regressions for education returns we have to re-categorize the 6 levels of education qualifications into three groups: (0-2) lower secondary education or below; (3-4) (upper) or post-secondary education; (5) degree+.

The EU SILC can provide rich information on employees' earnings and working hours. Employee income is defined as the total remuneration, in cash or in kind, payable by an employer to an employee in return for work done by the latter during the income reference period (12 months). The employee take-home income is broken down into: Gross employee cash or near cash income (PY010G); Gross non-cash employee income (PY020G). We combine these two components and divided by number of hours usually worked on his/her main job during the income reference period to get the hourly wage. In order to get more accurate measurement, we restrict the sample for the education return regressions only for fulltime employees who work more than 30 hours per week on his/her main job. All earnings are measured in euros so that they can be compared across countries and over time.

Data on the labour status and personal characteristics (education age, gender, etc.) come from micro data from the EU Labour Force Survey with the same ISCED education classification. The data on graduates, new entrants and enrolments by level of education come from Eurostat Education Statistics. The aim of the education statistics domain is to provide comparable statistics and indicators on key aspects of the education systems across Europe. The data cover participation and completion of education programmes by pupils and students, personnel in education and the cost and type of resources dedicated to education. They are obtained according to the standards on international statistics on education and training systems. These are set by the three international organisations jointly administering the UOE data collection: the United Nations Educational, Scientific, and Cultural Organisation Institute for Statistics (UNESCO-UIS), the Organisation for Economic Co-operation and Development (OECD) and the Statistical Office of the European Union (EUROSTAT). In particular the data collection on education statistics is based on the International Standard Classification of Education (ISCED-97). The reference period is the financial year for expenditure data, the calendar year for data on graduates and the school/academic year for all other non-monetary data (e.g. students enrolled, new entrants etc.).[3]

[3] In the presentations of non-monetary statistics other than on graduates, "2007" stands for school/academic year 2006/7, "2007" for 2007/8 and so on. Furthermore in some cases, when the data

Data on the theoretical number of years it takes to complete each level of education are based on data obtained from Eurydice. The Eurydice Network provides information on and analyses of European education systems and policies. As of 2011, it consists of 37 national units based in all 33 countries participating in the EU's Lifelong Learning programme (EU Member States, EFTA countries, Croatia and Turkey) and is coordinated and managed by the EU Education, Audiovisual and Culture Executive Agency in Brussels.

The probabilities of graduation are based on completion rates estimated for each level of education, gender and country according to the "cross-section cohort method". This method provides a completion rate through the ratio of the number of students who are awarded an initial degree to the number of new entrants to the level *n* years before, *n* being the number of years of full-time study required to complete the degree.[4]

Data on enrolment, graduation and new entrants by year, sex and level of education were taken from the Eurostat Education and Training statistics. The two main educational groups taken into account are 1) upper secondary and post-secondary non tertiary education and 2) higher education. For enrolment in higher education availability of data for Luxembourg was scarce, so data were interpolated from the UNESCO education statistics. In the case of the UK, there is a break in the Eurostat series between 2005 and 2006, so the UNESCO growth rates were used to estimate the data between 2000 and 2004.

Regarding the number of graduates used to calculate the probabilities of graduation, data were interpolated when not available. In the case of Luxembourg, there is no data availability for higher education graduates in Eurostat, UNESCO or the OECD education databases and not even in the education statistics portal from Luxembourg.

Data on new entrants to upper-secondary or higher education were more difficult to collect. The main data source was Eurostat (UNESCO does not provide this kind of data) or OECD when available. When data were not available at Eurostat or OECD, they were estimated by means of the enrolment growth rates. We have to take into account that new entrants are needed to estimate an approximation for the probability of graduation, dividing the number of graduates in a given year by the new entrants *n* years before. In the cases where there were a few years not available, they were interpolated using average annual growth rates. In cases where there were no data available for some levels of education, new entrants were estimated as the ratio between total enrolment in the year of entry and the number of years to attain the level of education. Again, the biggest problem found was with Luxembourg, which does not provide data for higher education, so the estimation of the probability of graduation for Luxembourg is

showed strange evolutions, we checked Eurostat data comparing them with the UNESCO education data in order to increase reliability.

[4] The method assumes constant student flows, owing to the need for consistency between the graduate cohort in the reference year and the entrant cohort n years before. This assumption may be less reliable in systems in which enrolments fluctuate markedly, students are faced with many different options as regards the length of courses for which they may enroll or in which there are many changes in programmes between the years of admission and graduation respectively. In those cases with a completion rate above one we assumed a value of one. When data of new entrants were lacking, we proxy them through the total number of students enrolled *n* years before divided by *n*.

problematic and this country was not included in the approximation for which the probability of graduation was needed.

We have also calculated the incremental earnings equations taking into account a correction for the education outcomes related to the working life of each individual depending on the level of education attained:

$$\varphi *_{ISCED3\text{-}4} = \frac{65-\text{MWA}-AY_{3\text{-}4}}{65-\text{MWA}} \varphi_{ISCED3\text{-}4} \quad [6]$$

Years between completing upper secondary education and entering the labour market calculated as the difference between the typical age of graduation from upper secondary education and the minimum age of the country to enter the labour market. The minimum age to enter the labour market is taken from the minimum age convention ratifications from the ILO. The typical age of graduation is taken from the Structure of the European Education Systems 2011/12 (Eurydice).

$$\varphi *_{ISCED5\text{-}6} = \frac{65-\text{MWA}-AY_{3\text{-}4}-AY_{5\text{-}6}}{65-\text{MWA}-AY_{3\text{-}4}} \varphi_{ISCED5\text{-}6} \quad [7]$$

where MWA is the minimum working age, $AY_{3\text{-}4}$ are the average years between completing ISCED 3-4 and entering the labour market and $AY_{5\text{-}6}$ are the average years between completing ISCED 3-4 and ISCED 5-6 for each of the countries analyzed.

Estimation: employment equations

The data on labour status come from the EU Labour Force Survey. In order to take account of the impact of education on economic activity we model the probability of an individual being in one of two states. Thus, individuals can either be employed or not employed (unemployed or economically inactive or in military service), which is what we call the probability of employment for people of working age. The probability that an individual is employed is estimated using a logit probability model. Thus, the probability of being employed, Pr (emp = 1), is given by:

$$\Pr(emp_u = 1|\, i_u, x, C_{jz}) \equiv \Pr(emp_u = 1|V_u) = \frac{\exp(V_u\psi)}{1+\exp(V_u\psi)} = \frac{1}{1+\exp(V_u\psi)} \quad [8]$$

where *V* is a vector of explanatory variables, including levels of education received (*i*), age (*x*) and a set of control variables (*C*), and Ψ is a vector of parameters to be estimated. The control variables are comparable to the ones used in the wage equations: two education dummies (one for ISCED=3/4, another for ISCED=5 and above, hence the baseline group is ISECD=0/2); a cubic age term and a migration dummy (1=local people, 0=migration). We estimate this equation using the data of EU LFS.

Estimation issues: wage equations

Wage premiums to education are estimated through gender specific standard Mincer wage equations (one for males and another for females) in order to control for other personal characteristics that can also affect wages apart from education.

$$\ln(W_{tj}) = \beta_o + \sum_i \beta_i i_{tj} + \beta_{21} x_{tj} + \beta_{22} x_{tj}^2 + \beta_{23} x_{tj}^3 + \sum_z \beta_{3z} C_{ztj} + \varepsilon_{tj} \quad [9]$$

where W = gross hourly wage earnings of individual j in period t, i = levels of education/qualifications achieved, x = experience, C = a vector of z control variables), ε = an error term $\varepsilon \sim N(0, \sigma)$. The coefficient β_i represents the total wage gain of achieving qualification *i* over the compulsory education level.

The selection of the set of controls to be included in the wage equation is very important because the interpretation of the estimated returns parameter depends on the specific mix of control variables. There are many variables relevant in determining wages. For example, experience, occupation, industry, size of establishment, co-workers schooling, manager's schooling, nationality, gender, type of contract, etc. Not all of them, however, should be included in the earning equation in our case given our aim. For example, some occupations and industries mean higher wages for a given amount of schooling. On the other hand, more education increases the probability of being employed in better occupations and industries. Adding occupation or industry variables would tend to decrease the estimated returns to education because some of its positive effects would be captured by these controls. We must distinguish between those wage equations trying to explain as completely as possible the determinants of wages and those wage equations aiming at estimating the total returns to education. We are interested in this last issue. Therefore, our vector of control variables does not include any wage determinant which is, in fact, a channel through which schooling produces a part of its returns. As a result, it only includes personal characteristics namely a marital status dummy (1= never married) and a migrant dummy (1=local people).

Wage equations results

The results of the earning regressions for the European countries analysed are summarized in Tables 2 and 3, which offer the estimated marginal returns to each level of education. All levels of post-compulsory education show positive incremental returns. The average estimated increment for secondary post-compulsory education is 26.3% for females and 23.0% for males. The increment is more important for tertiary education with an additional rise of 38.5% for females and 36.8% for males. As we can see the returns to education are somewhat stronger in the case of females. This pattern is quite general in secondary education with some exceptions such as Germany, Norway, Sweden, Belgium and the UK. For tertiary education there are more countries where returns are not stronger for females such as Germany, Norway and Sweden again, but also France, Hungary, Italy, Czech Republic, Denmark or the Netherlands among others.

As expected the individual results exhibit a wide degree of heterogeneity. The estimates of the secondary returns for females are as low as 10.2% in Sweden and as high as 43.3% in Portugal and for males as low as 11.6% in Finland and as high as 42.6% in Portugal. For tertiary we find the lowest returns again in some Nordic countries (Sweden in the case of females, 13.1%, and Denmark in the case of males, 16.8%) and the highest in Poland for females (71.0%) and in

Hungary for males (70.0%). The coefficient of variation across countries of those estimates show differences that are bigger in tertiary education than in secondary education and also bigger for females than for males.

The individual results exhibit a wide degree of variation over time, but the European averages are rather stable over the period analyzed. The female estimates range between 26.2% and 27.3% for the marginal return to secondary education and between 37.1% and 40.9% for tertiary education. The male estimates range between 22.0% and 24.8% and between 36.8% and 38.2% respectively. Overall there are not any distinct general trends for the returns of post-compulsory education in Europe during the period considered.

Table 2 Regression coefficients: marginal returns to education 2005-2009. Women.

	Upper/post secondary education								Tertiary education							
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Av.**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Av.**
Austria		0.250	0.387	0.376	0.274	0.328	0.353	0.328		0.298	0.283	0.365	0.314	0.319	0.337	0.319
Belgium		0.213	0.212	0.135	0.137	0.166	0.175	0.173		0.314	0.250	0.283	0.304	0.241	0.259	0.275
Bulgaria						0.424	0.329	0.377						0.429	0.453	0.441
Cyprus			0.399	0.354	0.451	0.468	0.482	0.431			0.508	0.572	0.521	0.525	0.524	0.530
Czech Republic			0.373	0.347	0.383	0.293	0.322	0.344			0.397	0.455	0.451	0.420	0.407	0.426
Denmark	0.174	0.189	0.253	0.197	0.199	0.174	0.166	0.193	0.070	0.164	0.152	0.142	0.192	0.131	0.150	0.143
Estonia		0.182	0.232	0.216	0.245	0.199	0.254	0.221		0.393	0.418	0.466	0.459	0.461	0.411	0.435
Finland		0.056	0.043	0.118	0.154	0.176	0.172	0.120		0.304	0.332	0.255	0.307	0.304	0.315	0.303
France		0.171	0.207	0.223	0.241	0.241	0.240	0.220		0.380	0.330	0.310	0.325	0.322	0.319	0.331
Germany			0.277	0.256	0.198	0.282	0.260	0.255			0.203	0.285	0.217	0.236	0.262	0.241
Greece		0.287	0.360	0.298	0.309	0.267	0.334	0.309		0.447	0.410	0.420	0.495	0.502	0.488	0.460
Hungary			0.304	0.357	0.332	0.296	0.283	0.314			0.534	0.570	0.585	0.558	0.539	0.557
Iceland		0.172	0.099	0.129	0.125	0.153	0.117	0.133		0.250	0.229	0.231	0.175	0.232	0.278	0.233
Ireland		0.264	0.272	0.318	0.239	0.303	0.079	0.246		0.440	0.451	0.427	0.524	0.440	0.412	0.449
Italy		0.280	0.262	0.243	0.358	0.356	0.350	0.308		0.285	0.290	0.294	0.302	0.288	0.274	0.289
Latvia					0.291	0.380	0.360	0.344					0.652	0.679	0.640	0.657
Lithuania			0.222	0.310	0.223	0.168	0.243	0.233			0.691	0.703	0.678	0.583	0.636	0.658
Luxembourg	0.419	0.327	0.246	0.252	0.229	0.303	0.377	0.308	0.379	0.392	0.416	0.499	0.543	0.432	0.424	0.441
Netherlands			0.247	0.277	0.240	0.241	0.267	0.254			0.226	0.301	0.233	0.270	0.310	0.268
Norway	0.123	0.224	0.220	0.129	0.124	0.147	0.150	0.160	0.176	0.234	0.148	0.201	0.163	0.171	0.141	0.176
Poland			0.396	0.349	0.374	0.326	0.285	0.346			0.718	0.757	0.744	0.687	0.646	0.710
Portugal		0.434	0.435	0.456	0.493	0.396	0.382	0.433		0.663	0.680	0.660	0.677	0.703	0.670	0.676
Romania						0.319	0.282	0.301						0.586	0.600	0.593
Slovakia			0.315	0.321	0.332	0.279	0.431	0.336			0.300	0.318	0.356	0.331	0.309	0.323
Slovenia			0.392	0.404	0.284	0.342	0.276	0.340			0.508	0.513	0.544	0.515	0.451	0.506
Spain		0.245	0.228	0.273	0.332	0.314	0.266	0.276		0.320	0.398	0.366	0.342	0.337	0.391	0.359
Sweden		0.117	0.066	0.062	0.079	0.110	0.175	0.102		0.185	0.148	0.128	0.153	0.107	0.065	0.131
United Kingdom			0.255	0.190	0.176	0.184	0.152	0.191			0.248	0.285	0.385	0.414	0.433	0.353
Average	-	-	0.268	0.264	0.262	0.273	0.270	0.263	-	-	0.371	0.392	0.409	0.401	0.398	0.385

Table 3 Regression coefficients: marginal returns to education 2005-2009. Men.

	Upper/post secondary education								Tertiary education							
	2003	2004	2005	2006	2007	2008	2009	Av.	2003	2004	2005	2006	2007	2008	2009	Av.
Austria		0.236	0.286	0.331	0.338	0.409	0.288	0.315		0.261	0.295	0.285	0.281	0.211	0.263	0.266
Belgium		0.166	0.188	0.201	0.176	0.168	0.152	0.175		0.224	0.203	0.208	0.215	0.188	0.223	0.210
Bulgaria						0.345	0.336	0.341						0.342	0.390	0.366
Cyprus			0.146	0.146	0.148	0.114	0.128	0.136			0.348	0.327	0.373	0.299	0.279	0.325
Czech Republic			0.278	0.291	0.278	0.245	0.268	0.272			0.429	0.465	0.459	0.421	0.370	0.429
Denmark	0.106	0.209	0.191	0.193	0.158	0.090	0.181	0.161	0.176	0.198	0.186	0.145	0.187	0.157	0.127	0.168
Estonia		0.220	0.255	0.230	0.222	0.139	0.135	0.200		0.515	0.530	0.382	0.340	0.313	0.328	0.401
Finland		0.143	0.108	0.109	0.072	0.101	0.160	0.116		0.327	0.336	0.327	0.349	0.383	0.345	0.345
France		0.139	0.174	0.130	0.147	0.147	0.147	0.147		0.281	0.278	0.257	0.243	0.262	0.280	0.267
Germany			0.325	0.359	0.330	0.393	0.352	0.352			0.286	0.324	0.295	0.315	0.312	0.306
Greece		0.142	0.145	0.148	0.313	0.275	0.262	0.214		0.307	0.313	0.340	0.340	0.388	0.328	0.336
Hungary			0.209	0.310	0.270	0.265	0.310	0.273			0.691	0.732	0.680	0.695	0.704	0.700
Iceland		0.182	0.110	0.152	0.088	0.109	0.149	0.132		0.305	0.349	0.386	0.327	0.329	0.335	0.339
Ireland		0.250	0.171	0.146	0.283	0.204	0.183	0.206		0.345	0.327	0.408	0.285	0.299	0.325	0.332
Italy		0.218	0.192	0.182	0.290	0.265	0.270	0.236		0.341	0.355	0.360	0.366	0.324	0.339	0.348
Latvia					0.300	0.226	0.274	0.267					0.566	0.616	0.548	0.577
Lithuania			0.218	0.322	0.266	0.227	0.079	0.222			0.656	0.652	0.515	0.505	0.530	0.572
Luxembourg	0.301	0.255	0.248	0.335	0.283	0.251	0.272	0.278	0.457	0.465	0.476	0.435	0.451	0.468	0.499	0.464
Netherlands			0.204	0.169	0.186	0.161	0.182	0.180			0.270	0.339	0.292	0.284	0.319	0.301
Norway	0.205	0.211	0.130	0.372	0.319	0.272	0.195	0.243	0.264	0.280	0.249	0.198	0.174	0.200	0.147	0.216
Poland			0.431	0.350	0.358	0.319	0.257	0.343			0.631	0.674	0.643	0.580	0.583	0.622
Portugal		0.437	0.403	0.352	0.469	0.458	0.434	0.426		0.606	0.581	0.621	0.628	0.502	0.436	0.562
Romania						0.273	0.285	0.279						0.633	0.594	0.614
Slovakia			0.281	0.225	0.356	0.276	0.190	0.266			0.341	0.377	0.341	0.341	0.341	0.348
Slovenia			0.298	0.327	0.256	0.242	0.199	0.264			0.628	0.622	0.541	0.536	0.529	0.571
Spain		0.200	0.175	0.231	0.190	0.195	0.192	0.197		0.245	0.297	0.251	0.265	0.226	0.285	0.262
Sweden		0.224	0.092	0.140	0.087	0.122	0.129	0.132		0.176	0.217	0.151	0.159	0.187	0.181	0.179
United Kingdom			0.254	0.195	0.276	0.216	0.164	0.221			0.288	0.277	0.335	0.405	0.377	0.336
Average	-	-	0.220	0.238	0.248	0.232	0.220	0.230	-	-	0.382	0.382	0.371	0.372	0.368	0.368

Enrolment

It is clear that the output of the post-compulsory education sector will be closely linked to the number of students enrolled in that level of education. Therefore, it is useful to have a preliminary look at the enrolment figures in the EU countries during our period of analysis.

Table 4 offers the annual rates of growth of enrolment in post-compulsory secondary schooling and higher education. The most characteristic feature for the EU is stability during the period in overall terms. The EU registered a slightly positive growth during the period 2005-2009 at a rate of 0.14% per year, a growth which only gains some strength in 2009 with a rate of 0.55%. It must be mentioned that this evolution is the result of opposite performances according to gender (tables 5 and 6). While enrolment grew 0.45% per year for males, female enrolment decreased 0.11% per year. Looking at simple averages of EU countries the performance seems more positive with a general annual growth of 0.71% (being as high as 0.85% for males and positive also for females). This points out to the existence of significant differences in the evolution of enrolment between countries. Some small EU countries have annual rates of growth of enrolment above 2%. Among them we can mention Austria, Belgium, Denmark, Cyprus, Netherlands and Portugal. The evolution is completely different in Poland, Slovenia, Latvia, Hungary, Ireland or the UK. The magnitude of this heterogeneity is very similar for male and female enrolment. The standard deviation is slightly under 0.03 in both cases and also for the whole of enrolment.

Table 4. Enrolment growth in the European countries. (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		2.80%	3.00%	0.13%	3.74%	2.18%	2.37%
Belgium		0.34%	2.56%	0.71%	1.89%	5.60%	2.22%
Bulgaria						-0.94%	-0.94%
Cyprus			1.92%	3.53%	5.60%	9.40%	5.11%
Czech Republic			0.63%	1.56%	3.08%	2.33%	1.90%
Denmark	4.04%	5.00%	-1.24%	1.97%	0.52%	2.39%	2.11%
Estonia		3.66%	-0.04%	-0.38%	-3.21%	-1.77%	-0.35%
Finland		6.11%	1.99%	1.92%	1.18%	-2.98%	1.65%
France		3.00%	0.55%	-0.75%	-0.72%	-0.56%	0.30%
Germany			1.19%	0.67%	0.15%	-0.13%	0.47%
Greece		6.83%	-0.67%	-7.31%	4.94%	-0.03%	0.75%
Hungary			0.41%	-0.65%	-2.23%	-2.67%	-1.28%
Iceland		3.52%	3.76%	3.10%	3.93%	2.06%	3.27%
Ireland		0.49%	-2.54%	1.77%	-2.80%	1.89%	-0.24%
Italy		1.04%	1.32%	0.65%	0.12%	-0.42%	0.54%
Latvia					-2.71%	-2.28%	-2.50%
Lithuania			0.82%	-0.88%	1.03%	1.79%	0.69%
Netherlands			2.67%	2.49%	2.99%	2.01%	2.54%
Norway	2.25%	-0.35%	2.57%	2.70%	-0.20%	1.23%	1.37%
Poland			-1.19%	-1.43%	-1.44%	-0.21%	-1.07%
Portugal		-2.10%	-5.66%	1.24%	11.36%	8.60%	2.69%
Romania						0.62%	0.62%
Slovakia			1.80%	2.76%	0.49%	-0.19%	1.22%
Slovenia			-0.49%	-2.02%	-2.45%	-2.45%	-1.85%
Spain		0.76%	-1.07%	-0.40%	-0.10%	0.51%	-0.06%
Sweden		1.27%	0.66%	-1.08%	-1.65%	2.52%	0.34%
United Kingdom			-1.29%	0.70%	-3.68%	1.13%	-0.78%
Weighted Average			0.17%	0.07%	-0.20%	0.55%	0.14%
Simple Average			0.49%	0.46%	0.79%	1.10%	0.71%
Standard Deviation			0.021	0.023	0.034	0.031	0.027

Source: Eurostat, UNESCO and own elaboration.

Table 5 Enrolment growth in the European countries. Females. (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		3.27%	3.76%	-0.51%	3.66%	2.51%	2.54%
Belgium		1.59%	2.74%	1.23%	2.04%	5.33%	2.59%
Bulgaria						-0.61%	-0.61%
Cyprus			1.02%	2.56%	5.04%	6.96%	3.90%
Czech Republic			1.27%	2.90%	2.71%	3.81%	2.67%
Denmark	3.77%	4.19%	-1.49%	2.07%	0.65%	2.44%	1.94%
Estonia		3.18%	0.65%	-0.73%	-2.54%	-1.94%	-0.28%
Finland		5.82%	2.07%	1.87%	1.39%	-6.78%	0.87%
France		3.14%	0.44%	-0.83%	-0.89%	-0.42%	0.29%
Germany			1.11%	0.70%	-0.07%	0.35%	0.52%
Greece		5.40%	-1.09%	-7.63%	4.54%	-0.34%	0.18%
Hungary			1.00%	-0.67%	-2.98%	-3.53%	-1.55%
Iceland		3.49%	3.99%	3.76%	2.95%	2.40%	3.32%
Ireland		1.64%	-3.30%	1.82%	-4.06%	2.65%	-0.25%
Italy		1.29%	1.52%	0.51%	0.27%	-0.15%	0.69%
Latvia					-2.14%	-3.16%	-2.65%
Lithuania			0.70%	-0.71%	0.76%	0.97%	0.43%
Netherlands			2.70%	2.77%	3.14%	2.25%	2.71%
Norway	2.26%	-1.05%	2.25%	2.62%	-0.20%	1.20%	1.18%
Poland			-1.57%	-1.55%	-1.49%	-0.96%	-1.39%
Portugal		-2.68%	-5.64%	-0.47%	10.88%	7.45%	1.91%
Romania						0.93%	0.93%
Slovakia			3.75%	4.38%	2.09%	0.31%	2.63%
Slovenia			0.45%	-2.34%	-2.39%	-2.66%	-1.74%
Spain		0.72%	-0.92%	-0.06%	-0.46%	0.01%	-0.14%
Sweden		-0.04%	0.75%	-1.05%	-2.21%	1.85%	-0.14%
United Kingdom			-6.25%	0.47%	-3.45%	0.84%	-2.10%
Weighted Average			-0.59%	0.04%	-0.30%	0.43%	-0.11%
Simple Average			0.41%	0.46%	0.69%	0.80%	0.59%
Standard Deviation			0.027	0.025	0.033	0.032	0.029

Source: Eurostat, UNESCO and own elaboration.

Table 6 Enrolment growth in the European countries. Males. (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		2.32%	2.23%	0.79%	3.82%	1.84%	2.20%
Belgium		-1.10%	2.35%	0.10%	1.71%	5.93%	1.80%
Bulgaria						-1.30%	-1.30%
Cyprus			2.83%	4.49%	6.13%	11.75%	6.30%
Czech Republic			-0.05%	0.15%	3.48%	0.73%	1.08%
Denmark	4.36%	5.95%	-0.95%	1.86%	0.37%	2.34%	2.32%
Estonia		4.30%	-0.94%	0.09%	-4.11%	-1.53%	-0.44%
Finland		6.43%	1.91%	1.99%	0.95%	1.30%	2.51%
France		2.85%	0.67%	-0.65%	-0.55%	-0.72%	0.32%
Germany			1.27%	0.64%	0.35%	-0.57%	0.42%
Greece		8.29%	-0.25%	-6.99%	5.33%	0.28%	1.33%
Hungary			-0.25%	-0.63%	-1.35%	-1.69%	-0.98%
Iceland		3.56%	3.46%	2.24%	5.22%	1.61%	3.22%
Ireland		-0.72%	-1.72%	1.73%	-1.45%	1.11%	-0.21%
Italy		0.77%	1.10%	0.80%	-0.04%	-0.72%	0.38%
Latvia					-3.51%	-1.05%	-2.28%
Lithuania			0.98%	-1.10%	1.38%	2.84%	1.02%
Netherlands			2.65%	2.20%	2.84%	1.77%	2.36%
Norway	2.24%	0.47%	2.94%	2.79%	-0.19%	1.27%	1.59%
Poland			-0.76%	-1.30%	-1.39%	0.60%	-0.71%
Portugal		-1.41%	-5.67%	3.26%	11.90%	9.89%	3.59%
Romania						0.26%	0.26%
Slovakia			-0.31%	0.94%	-1.36%	-0.79%	-0.38%
Slovenia			-1.57%	-1.65%	-2.53%	-2.20%	-1.99%
Spain		0.80%	-1.24%	-0.79%	0.31%	1.07%	0.03%
Sweden		3.02%	0.53%	-1.12%	-0.92%	3.39%	0.98%
United Kingdom			5.11%	0.97%	-3.93%	1.47%	0.91%
Weighted Average			1.10%	0.10%	-0.09%	0.69%	0.45%
Simple Average			0.60%	0.45%	0.90%	1.44%	0.85%
Standard Deviation			0.022	0.022	0.036	0.033	0.028

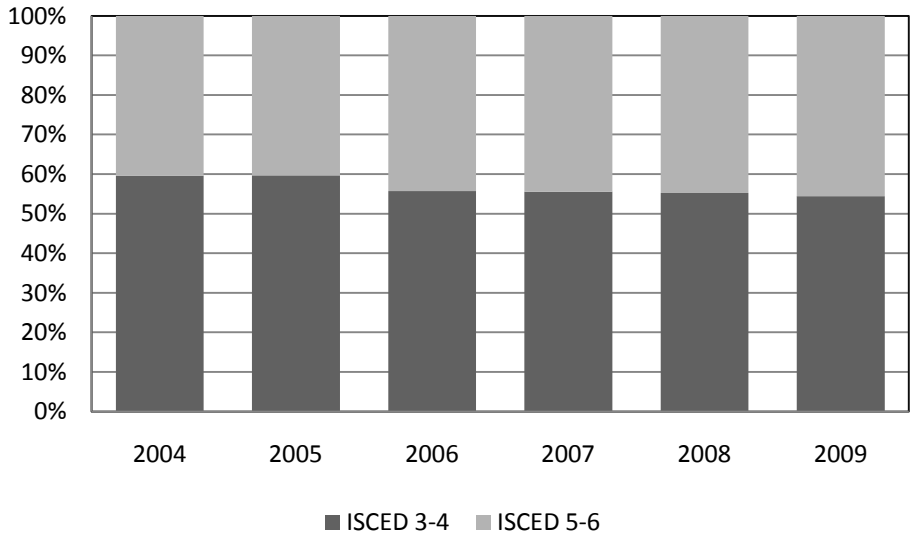
Source: Eurostat, UNESCO and own elaboration.

These data mean that we should expect also a very substantial heterogeneity between countries in terms of the rates of growth of output in post-compulsory education.

Figure 1 shows the composition of post-compulsory enrolment in the EU-27. We can notice a steady change of that composition towards an increased share of the tertiary education. Actually the EU-27 experienced a decrease of upper secondary education (ISCED 3) and post-secondary non-tertiary education (ISCED 4) in absolute terms while the enrolment in tertiary education went up in absolute terms. As a consequence tertiary education gained 6 percentage points during the period and accounted for 46% of the total enrolment in post-compulsory education in Europe in 2009.

This change towards levels of education with higher labour outcomes should have positive effects on the education output across Europe. Any indicator used to measure that output should be able to take that into account.

Figure 1. Post-compulsory enrolment composition. EU-27 2004-2009 (%)



Source: Eurostat

4. Results

In the previous sections we have discussed the method proposed to measure the output of post-compulsory education and the estimated labour outcomes of workers with that education in Europe. We have also reviewed the data on enrolment across the European countries. Now we will present the results obtained for the rates of growth of that part of the education sector in Europe during the period 2005-2009. As explained above, we present a number of different estimates according to specific assumptions about the relative importance of successful completion. Let us begin with the more standard scenario.

Intermediate case

As noted in a previous section, this scenario assumes that each year of schooling which does not contribute to a successful graduation represents only half of that in the case of a graduate.

Table 7 shows the results obtained. For the whole of European countries the estimated annual rate of growth for the period 2005-2009 is 0.47%. The results show a decreasing trend for the rate of growth over time with a substantial recovery for 2009, the most recent year of the period analyzed. This is probably a recession effect with few alternatives to young people other than remaining in education.

It is noteworthy that output experienced an absolute decrease in 2008 in these European countries as a whole, which is more difficult to explain. The simple average of the European

countries' national rates of growth show a more positive image with an average growth for the period of 1.52% per year. This means that, in general terms, output grew slower in the bigger countries than in the smaller ones.

Actually, our estimates present a wide variability across countries. Some of them have average growth rates close to 5% or over that figure. Cyprus, Czech Republic, the Netherlands, Portugal, Belgium, Austria or Demark are good examples. Others experienced an accumulated fall in their education output. Estonia, Hungary, Ireland, Poland, Slovenia, the UK and Spain pertain to this group.

Table 7. Output growth in the European countries. Intermediate case, (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		5.44%	5.76%	0.26%	6.46%	3.43%	4.27%
Belgium		0.69%	4.86%	0.91%	3.78%	10.97%	4.24%
Bulgaria						-1.77%	-1.77%
Cyprus			3.30%	7.40%	11.80%	17.02%	9.88%
Czech Republic			2.01%	3.61%	8.04%	5.83%	4.87%
Denmark	7.30%	9.52%	-2.40%	4.03%	1.09%	4.88%	4.07%
Estonia		7.04%	0.31%	-0.42%	-4.93%	-2.32%	-0.06%
Finland		7.39%	2.79%	2.01%	1.29%	-8.96%	0.91%
France		5.39%	1.09%	-1.56%	-1.48%	-0.95%	0.50%
Germany			2.48%	1.45%	0.73%	-0.97%	0.92%
Greece		13.54%	-0.51%	-15.68%	9.78%	0.09%	1.44%
Hungary			0.97%	-1.80%	-5.58%	-5.93%	-3.09%
Iceland		6.71%	7.48%	5.37%	7.64%	3.99%	6.24%
Ireland		0.18%	-4.17%	3.78%	-7.50%	3.70%	-0.80%
Italy		2.03%	2.27%	1.22%	0.28%	-0.97%	0.97%
Latvia					-4.56%	-4.61%	-4.58%
Lithuania			2.70%	-0.26%	3.60%	4.76%	2.70%
Netherlands			5.23%	4.73%	5.79%	4.01%	4.94%
Norway	4.35%	-0.97%	5.67%	6.61%	0.34%	2.05%	3.01%
Poland			-0.41%	-1.64%	-0.94%	-0.56%	-0.89%
Portugal		-5.11%	-10.64%	1.77%	19.15%	14.07%	3.85%
Romania						4.28%	4.28%
Slovakia			4.38%	6.23%	1.30%	0.08%	3.00%
Slovenia			0.04%	-2.36%	-3.78%	-3.90%	-2.50%
Spain		0.33%	-2.12%	-0.78%	-0.25%	1.12%	-0.34%
Sweden		2.35%	0.35%	-2.49%	-3.20%	4.95%	0.39%
United Kingdom			-1.56%	1.54%	-6.83%	3.62%	-0.81%
Weighted Average			0.72%	0.24%	-0.14%	1.08%	0.47%
Simple Average			1.24%	1.00%	1.68%	2.14%	1.52%
Standard Deviation			0.039	0.046	0.064	0.058	0.052

Table 8 presents the estimates corresponding to out extreme case 1. In this scenario we consider that each level of education only generates output if the student completes it successfully.

Overall, the aggregate estimates for the European countries are very similar to those of the previous scenario. The average rate of growth is 0.48%. Again we can observe a similar decreasing trend in growth with a sizeable recovery in 2009 after a brief negative growth in 2008. It is also noticeable that the difference between the simple average of the European countries' national rates, showing a faster growth of output (1.4% per year). This reflects that also when fully taking into account completion rates education output grew slower in the bigger countries than in the smaller ones.

Table 8. Output growth in the European countries. Extreme case 1, (%) per annum
Assumption: only graduation matters

	2004	2005	2006	2007	2008	2009	Average
Austria		5.42%	5.66%	0.12%	6.15%	3.34%	4.14%
Belgium		0.65%	5.03%	1.01%	3.77%	10.91%	4.28%
Bulgaria						-2.19%	-2.19%
Cyprus			3.09%	6.63%	9.70%	14.24%	8.41%
Czech Republic			1.92%	3.67%	8.23%	6.15%	4.99%
Denmark	7.21%	9.51%	-2.42%	4.06%	1.27%	5.00%	4.11%
Estonia		6.98%	0.30%	-0.67%	-5.21%	-2.62%	-0.24%
Finland		7.34%	2.88%	2.04%	1.25%	-9.31%	0.84%
France		5.65%	1.08%	-1.51%	-1.49%	-1.13%	0.52%
Germany			2.53%	1.59%	0.88%	-0.73%	1.07%
Greece		13.22%	-0.75%	-15.76%	9.54%	0.00%	1.25%
Hungary			0.97%	-1.65%	-5.36%	-6.09%	-3.03%
Iceland		6.83%	7.41%	5.85%	7.35%	4.05%	6.30%
Ireland		0.11%	-4.13%	3.80%	-7.77%	3.75%	-0.85%
Italy		2.04%	2.34%	1.30%	0.47%	-1.00%	1.03%
Latvia					-4.78%	-5.10%	-4.94%
Lithuania			2.67%	-0.35%	3.47%	4.65%	2.61%
Netherlands			5.24%	4.78%	5.89%	3.94%	4.96%
Norway	4.53%	-1.13%	5.95%	6.85%	0.50%	1.80%	3.08%
Poland			-0.82%	-1.87%	-1.24%	-0.41%	-1.09%
Portugal		-5.24%	-10.81%	1.55%	19.73%	14.32%	3.91%
Romania						4.21%	4.21%
Slovakia			4.00%	5.83%	1.25%	0.01%	2.77%
Slovenia			-0.50%	-3.09%	-4.35%	-4.29%	-3.06%
Spain		0.11%	-2.10%	-0.75%	-0.26%	1.14%	-0.37%
Sweden		1.80%	-0.04%	-2.61%	-3.04%	5.20%	0.26%
United Kingdom			-0.86%	1.55%	-7.00%	3.48%	-0.71%
Weighted Average			0.77%	0.24%	-0.15%	1.08%	0.48%
Simple Average			1.19%	0.93%	1.56%	1.97%	1.41%
Standard Deviation			0.039	0.046	0.063	0.056	0.051

Considering completion rates does not eliminate the heterogeneity of the results between countries, and the pattern is similar with countries such as Cyprus, Czech Republic, the Netherlands, Portugal, Austria or Denmark growing quickly and others showing a decrease over the period analyzed – these again include Estonia, Hungary, Ireland, Poland, Slovenia, the UK and Spain. However, there are some interesting changes in some countries compared to the previous estimates. After taking into account completion rates Cyprus experiences a sizeable decrease of its rate of growth (-1,4 p.p.). For other countries this decrease is much smaller but still noticeable. This includes countries such as Austria, Estonia, Greece, Latvia, Lithuania, Poland, Slovakia, Slovenia and Sweden. However, considering only graduation benefits other countries such as Czech Republic, the UK and, especially, Germany (+0.15% per year).

The opposite possibility in terms of the relative value of graduation is our extreme case 2. In this scenario we assume that each year of schooling generates always the same output, disregarding actual graduation or lack of it. Table 9 shows the results under this assumption. The overall pattern for the aggregate European data does not show significant changes in respect to the two previous scenarios. Both the average growth and the time evolution are very similar to the ones already commented above. Nevertheless dropping the issue of success in graduation does have some implications for the estimated performance of each country, although the changes are not dramatic by any means. Taking as a benchmark our first results (our intermediate scenario) now Cyprus shows a much faster rate of growth (with an increase of 1.1 p.p. per year). Other countries show a similar but more moderate change: Austria, Estonia, Greece, Poland, Slovakia and Slovenia. The output performance is somewhat adversely affected in Germany, Czech Republic and UK among others.

Table 9. Output growth in the European countries. Extreme case 2, (%) per annum
Assumption: graduation does not matter

	2004	2005	2006	2007	2008	2009	Average
Austria		5.45%	5.83%	0.36%	6.71%	3.51%	4.37%
Belgium		0.72%	4.70%	0.82%	3.78%	11.02%	4.21%
Bulgaria						-1.42%	-1.42%
Cyprus			3.47%	8.01%	13.39%	19.10%	10.99%
Czech Republic			2.08%	3.56%	7.90%	5.58%	4.78%
Denmark	7.35%	9.52%	-2.38%	4.00%	0.95%	4.78%	4.04%
Estonia		7.08%	0.31%	-0.27%	-4.77%	-2.14%	0.04%
Finland		7.42%	2.73%	1.99%	1.32%	-8.72%	0.95%
France		5.18%	1.11%	-1.59%	-1.48%	-0.80%	0.48%
Germany			2.45%	1.33%	0.61%	-1.15%	0.81%
Greece		13.79%	-0.32%	-15.61%	9.95%	0.15%	1.59%
Hungary			0.97%	-1.90%	-5.72%	-5.84%	-3.12%
Iceland		6.61%	7.54%	4.94%	7.91%	3.93%	6.19%
Ireland		0.26%	-4.22%	3.76%	-7.24%	3.65%	-0.76%
Italy		2.03%	2.20%	1.16%	0.12%	-0.95%	0.91%
Latvia					-4.43%	-4.34%	-4.38%
Lithuania			2.72%	-0.19%	3.69%	4.82%	2.76%
Luxembourg	3.56%	1.39%	4.28%	12.45%	13.01%	12.65%	7.89%
Netherlands			5.22%	4.68%	5.70%	4.07%	4.92%
Norway	4.22%	-0.84%	5.46%	6.44%	0.21%	2.26%	2.96%
Poland			-0.08%	-1.46%	-0.72%	-0.68%	-0.73%
Portugal		-5.05%	-10.56%	1.89%	18.81%	13.93%	3.80%
Romania						4.35%	4.35%
Slovakia			4.71%	6.58%	1.33%	0.14%	3.19%
Slovenia			0.45%	-1.80%	-3.37%	-3.62%	-2.08%
Spain		0.48%	-2.14%	-0.81%	-0.24%	1.11%	-0.32%
Sweden		2.60%	0.53%	-2.44%	-3.28%	4.85%	0.45%
United Kingdom			-2.10%	1.54%	-6.70%	3.73%	-0.88%
Weighted Average			0.68%	0.24%	-0.13%	1.09%	0.47%
Simple Average			1.40%	1.50%	2.21%	2.64%	1.94%
Standard Deviation			0.038	0.051	0.066	0.062	0.032

In summary, the results show that the completion rate effect and the issue of the relative value to assign to years of schooling, depending on graduation or not, have only a moderate importance for most of the European countries over the period analyzed. This reflects the fact that there are not great changes over time on the completion rates of each country during those few years and means that we can be more confident about the estimates obtained for this specific period.

Nevertheless this might be an important problem for other periods with completion rates either improving or worsening strongly. Furthermore, it would be an important issue when trying to obtain relative levels of output between countries. It is obvious that even differences

of completion rates between countries which are constant over time may have important effects on the levels of output of each country, in spite of not affecting their growth rates.

Probability of employment effect

The previous estimates of output growth are based on education outcomes which consider the effect of education on both wages and probabilities of employment (including both participation and unemployment probabilities). Nevertheless, as explained in the methodology section, our approach allows us to consider also counterfactual situations to try to disentangle the effect of those labour market probabilities. Probabilities of participation and unemployment might depend more on individual willingness, labour institutions and other external factors than on the education sector. Focusing only on wages and excluding employment probabilities it is possible to obtain alternative estimates of the potential output of education centered on its productivity effect. By comparing these new estimates with the previous ones we get an idea of the size of the impact of the probability of employment on the expected output of education.

Tables 10, 11 and 12 contain the new estimates for the three scenarios we have defined regarding successful completion (the intermediate case and the two extreme cases) when we consider probability of employment to be always 1 . Since, as we have seen above, the results are qualitatively similar for all those three scenarios we will focus our comments in the new estimates for the intermediate case (table 11).

Table 10. Output growth in the European countries. Extreme case 1 with probability of employment=1, (%) per annum
Assumption: only graduation matters

	2004	2005	2006	2007	2008	2009	Average
Austria		5.59%	5.78%	-0.48%	5.39%	2.42%	3.74%
Belgium		0.94%	5.39%	1.38%	3.78%	10.78%	4.45%
Bulgaria						-3.37%	-3.37%
Cyprus			3.09%	5.59%	7.79%	11.96%	7.11%
Czech Republic			1.22%	3.53%	6.83%	5.79%	4.34%
Denmark	6.53%	9.00%	-2.46%	4.12%	1.39%	5.09%	3.95%
Estonia		6.99%	0.24%	-0.88%	-5.59%	-3.06%	-0.46%
Finland		7.99%	3.16%	2.47%	1.56%	-9.25%	1.18%
France		5.86%	1.03%	-1.51%	-1.53%	-1.24%	0.52%
Germany			2.53%	1.75%	1.01%	-1.80%	0.87%
Greece		12.19%	-1.75%	-15.39%	9.17%	-0.25%	0.79%
Hungary			1.03%	-1.35%	-4.94%	-5.79%	-2.77%
Iceland		6.84%	7.45%	6.12%	7.11%	4.12%	6.33%
Ireland		0.71%	-4.84%	3.71%	-7.31%	3.82%	-0.78%
Italy		2.02%	2.55%	1.25%	0.73%	-0.98%	1.11%
Latvia					-5.05%	-5.30%	-5.17%
Lithuania			2.26%	-1.01%	2.88%	4.16%	2.07%
Netherlands			5.24%	4.91%	6.01%	3.92%	5.02%
Norway	4.73%	-1.27%	6.16%	7.05%	0.58%	1.61%	3.14%
Poland			-2.27%	-2.69%	-2.50%	-0.53%	-2.00%
Portugal		-4.70%	-11.44%	1.82%	21.68%	16.16%	4.71%
Romania						2.63%	2.63%
Slovakia			2.36%	4.36%	0.56%	-0.59%	1.67%
Slovenia			-1.36%	-4.42%	-5.04%	-4.96%	-3.94%
Spain		0.91%	-2.06%	-0.57%	-0.53%	0.74%	-0.30%
Sweden		1.97%	0.09%	-2.55%	-3.09%	5.05%	0.29%
United Kingdom			-1.34%	1.52%	-7.12%	3.28%	-0.92%
Weighted Average			0.49%	0.17%	-0.29%	0.83%	0.30%
Simple Average			0.92%	0.78%	1.35%	1.65%	1.17%
Standard Deviation			0.041	0.046	0.064	0.057	0.052

Table 11. Output growth in the European countries. Intermediate case with probability of employment=1, (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		5.61%	5.88%	-0.37%	5.66%	2.50%	3.86%
Belgium		0.96%	5.23%	1.29%	3.78%	10.83%	4.42%
Bulgaria						-2.95%	-2.95%
Cyprus			3.27%	6.34%	9.81%	14.62%	8.51%
Czech Republic			1.33%	3.49%	6.66%	5.49%	4.24%
Denmark	6.61%	9.01%	-2.44%	4.09%	1.22%	4.98%	3.91%
Estonia		7.04%	0.23%	-0.63%	-5.27%	-2.73%	-0.27%
Finland		8.07%	3.09%	2.46%	1.60%	-8.92%	1.26%
France		5.61%	1.05%	-1.54%	-1.52%	-1.07%	0.50%
Germany			2.49%	1.62%	0.88%	-2.08%	0.73%
Greece		12.50%	-1.50%	-15.36%	9.41%	-0.16%	0.98%
Hungary			1.01%	-1.52%	-5.17%	-5.69%	-2.84%
Iceland		6.73%	7.51%	5.63%	7.42%	4.05%	6.27%
Ireland		0.80%	-4.89%	3.69%	-7.04%	3.78%	-0.73%
Italy		2.02%	2.48%	1.20%	0.57%	-0.94%	1.06%
Latvia					-4.78%	-4.86%	-4.82%
Lithuania			2.31%	-0.88%	3.07%	4.33%	2.21%
Netherlands			5.23%	4.86%	5.91%	3.99%	5.00%
Norway	4.55%	-1.10%	5.89%	6.82%	0.42%	1.86%	3.07%
Poland			-1.81%	-2.42%	-2.12%	-0.63%	-1.74%
Portugal		-4.59%	-11.29%	2.01%	21.10%	15.91%	4.63%
Romania						2.72%	2.72%
Slovakia			2.73%	4.72%	0.60%	-0.55%	1.88%
Slovenia			-0.80%	-3.65%	-4.46%	-4.56%	-3.37%
Spain		1.16%	-2.08%	-0.60%	-0.51%	0.72%	-0.26%
Sweden		2.50%	0.50%	-2.42%	-3.26%	4.80%	0.42%
United Kingdom			-2.07%	1.51%	-6.96%	3.41%	-1.02%
Weighted Average			0.44%	0.18%	-0.27%	0.83%	0.29%
Simple Average			0.97%	0.85%	1.48%	1.81%	1.28%
Standard Deviation			0.041	0.045	0.064	0.058	0.052

Table 12. Output growth in the European countries. Extreme case 2 with probability of employment=1, (%) per annum
Assumption: graduation does not matter

	2004	2005	2006	2007	2008	2009	Average
Austria		5.63%	5.95%	-0.28%	5.88%	2.56%	3.95%
Belgium		0.99%	5.09%	1.20%	3.79%	10.87%	4.39%
Bulgaria						-2.60%	-2.60%
Cyprus			3.43%	6.94%	11.36%	16.66%	9.60%
Czech Republic			1.42%	3.46%	6.54%	5.26%	4.17%
Denmark	6.67%	9.03%	-2.42%	4.06%	1.08%	4.88%	3.88%
Estonia		7.08%	0.23%	-0.49%	-5.09%	-2.55%	-0.16%
Finland		8.13%	3.04%	2.45%	1.64%	-8.69%	1.31%
France		5.39%	1.06%	-1.58%	-1.51%	-0.92%	0.49%
Germany			2.46%	1.51%	0.77%	-2.29%	0.61%
Greece		12.75%	-1.29%	-15.34%	9.59%	-0.08%	1.13%
Hungary			1.01%	-1.62%	-5.32%	-5.63%	-2.89%
Iceland		6.63%	7.56%	5.18%	7.71%	3.99%	6.21%
Ireland		0.89%	-4.94%	3.67%	-6.78%	3.74%	-0.69%
Italy		2.02%	2.43%	1.15%	0.42%	-0.92%	1.02%
Latvia					-4.63%	-4.60%	-4.62%
Lithuania			2.34%	-0.78%	3.19%	4.44%	2.30%
Luxembourg	4.38%	1.95%	4.97%	10.92%	11.12%	10.57%	7.32%
Netherlands			5.22%	4.82%	5.83%	4.06%	4.98%
Norway	4.42%	-0.97%	5.68%	6.65%	0.31%	2.07%	3.02%
Poland			-1.43%	-2.20%	-1.82%	-0.70%	-1.54%
Portugal		-4.54%	-11.22%	2.11%	20.75%	15.78%	4.58%
Romania						2.80%	2.80%
Slovakia			3.06%	5.03%	0.64%	-0.51%	2.05%
Slovenia			-0.36%	-3.04%	-4.03%	-4.25%	-2.92%
Spain		1.32%	-2.10%	-0.62%	-0.50%	0.71%	-0.24%
Sweden		2.74%	0.69%	-2.37%	-3.33%	4.69%	0.48%
United Kingdom			-2.63%	1.51%	-6.83%	3.51%	-1.11%
Weighted Average			0.41%	0.19%	-0.24%	0.84%	0.30%
Simple Average			1.17%	1.29%	1.95%	2.24%	1.67%
Standard Deviation			0.040	0.049	0.066	0.060	0.031

The average aggregate rate of growth for the 27 European countries is just slightly lower now, showing that the evolution of the probability of employment during the period 2005-2009 had a small but positive effect on the output of the education sector. This small positive impact is roughly constant every year and, therefore, the temporal pattern of output growth hardly varies. The decreasing trend and the sharp recovery in the last years are maintained.

In spite of the aggregate similarities, there are some changes when we turn our attention towards the national estimates. Some Eastern European countries present a slower output growth. This happens in Poland, Romania, Slovenia and Czech Republic. Therefore, in those

countries the evolution of their employment probability contributes to push the growth rate of their education output. In Finland the opposite happens and disregarding the probability of employment increases the growth of the output of its post-compulsory education. Nevertheless the variation moves within a range of a few percentage points for most countries.

Again, this small effect does not imply that this problem has no relevance on measuring the output of education. When there are not great changes over time in the relative probabilities of employment by education level within each country the final impact has to be small. The effect would much more sizeable during periods characterized by strong increases of decreases of the probabilities of employment. It might be also a very important problem when looking at the levels of output of each country instead of their rates of growth.

Output per student

It is interesting to combine the estimates of the growth rates of output in the European post-compulsory education sector with the evolution of enrolment for two reasons. Firstly, it allows us to determine whether this approach adds to our understanding of the performance of the education sector in Europe. In a sense a measure of output per student is an indicator of the productivity of the education sector. An increase of the education output per student has clearly quite different implications for policy design than a decrease. Secondly, it is interesting to see to what extent this approach adds to the measurement of the output of the education sector compared to using simply the enrolment data as an indicator.

Tables 13 onwards show the rates of growth of the output per student for different scenarios. It is useful to have in mind the previous analyses of the sensitivity of our estimates to different assumptions about the value of completion and the role of the employment probability. We will base our comments on the estimates corresponding to the intermediate scenario with probability of employment (table 14) corresponding to the first estimates discussed in this paper (table 7).

The average results for the European countries and the whole period indicate that the output per student would have grown at an annual rate of 0.33%. This means a rate of growth for output as high as twice the one corresponding to enrolment. The greatest annual increase, 0.53%, happens in 2009.

The heterogeneity in terms of the growth of the output per student across Europe seems as high as in terms of the enrolment growth. The more pronounced reductions are those of Latvia, Slovenia, Hungary and Poland. Other countries also show a decrease in that ratio: Ireland, Spain and the UK. In the opposite situation we find the remaining countries. For some of them the increase is quite substantial. In particular we can notice the cases of Cyprus, Czech Republic, Netherlands, Belgium, Denmark and Austria. In all those countries the output per student in the post-compulsory education sector present annual average growth rates above 1.5% during the period 2005-2009.

This comparison shows that taking into account the labour market outcomes does make a difference when measuring the output of the education sector. It adds to our knowledge of the

results of the education sector. Furthermore it shows an even more heterogeneous situation between the European Union members.

Table 13. Output per student growth in the European countries. Extreme case 1, (%) per annum
Assumption: only graduation matters

	2004	2005	2006	2007	2008	2009	Average
Austria		2.62%	2.66%	-0.01%	2.41%	1.16%	1.77%
Belgium		0.31%	2.47%	0.30%	1.88%	5.31%	2.05%
Bulgaria						-1.24%	-1.24%
Cyprus			1.17%	3.10%	4.10%	4.83%	3.30%
Czech Republic			1.30%	2.10%	5.15%	3.83%	3.09%
Denmark	3.17%	4.51%	-1.18%	2.09%	0.75%	2.61%	1.99%
Estonia		3.32%	0.34%	-0.29%	-2.00%	-0.85%	0.10%
Finland		1.23%	0.88%	0.11%	0.07%	-6.33%	-0.81%
France		2.65%	0.53%	-0.77%	-0.77%	-0.57%	0.22%
Germany			1.34%	0.93%	0.73%	-0.61%	0.60%
Greece		6.39%	-0.07%	-8.45%	4.60%	0.03%	0.50%
Hungary			0.56%	-1.00%	-3.14%	-3.42%	-1.75%
Iceland		3.31%	3.65%	2.75%	3.41%	1.99%	3.02%
Ireland		-0.39%	-1.59%	2.03%	-4.97%	1.85%	-0.61%
Italy		1.00%	1.02%	0.65%	0.34%	-0.58%	0.49%
Latvia					-2.07%	-2.82%	-2.44%
Lithuania			1.85%	0.53%	2.44%	2.85%	1.92%
Netherlands			2.57%	2.29%	2.89%	1.93%	2.42%
Norway	2.28%	-0.78%	3.38%	4.15%	0.70%	0.57%	1.71%
Poland			0.36%	-0.44%	0.20%	-0.20%	-0.02%
Portugal		-3.14%	-5.15%	0.31%	8.38%	5.72%	1.22%
Romania						3.59%	3.59%
Slovakia			2.20%	3.07%	0.76%	0.20%	1.56%
Slovenia			-0.01%	-1.07%	-1.90%	-1.84%	-1.21%
Spain		-0.65%	-1.03%	-0.35%	-0.16%	0.63%	-0.31%
Sweden		0.54%	-0.70%	-1.54%	-1.39%	2.68%	-0.08%
United Kingdom			0.43%	0.84%	-3.32%	2.35%	0.07%
Weighted Average			0.60%	0.17%	0.06%	0.53%	0.34%
Simple Average			0.71%	0.47%	0.76%	0.88%	0.71%
Standard Deviation			0.019	0.024	0.030	0.027	0.025

Table 14. Output per student growth in the European countries. Intermediate case, (%) per annum

	2004	2005	2006	2007	2008	2009	Average
Austria		2.64%	2.75%	0.13%	2.72%	1.25%	1.90%
Belgium		0.34%	2.30%	0.20%	1.88%	5.37%	2.02%
Bulgaria						-0.83%	-0.83%
Cyprus			1.39%	3.88%	6.21%	7.62%	4.77%
Czech Republic			1.38%	2.05%	4.96%	3.50%	2.97%
Denmark	3.26%	4.52%	-1.16%	2.06%	0.58%	2.48%	1.95%
Estonia		3.39%	0.34%	-0.04%	-1.72%	-0.55%	0.29%
Finland		1.28%	0.80%	0.08%	0.11%	-5.97%	-0.74%
France		2.39%	0.55%	-0.81%	-0.76%	-0.39%	0.20%
Germany			1.29%	0.78%	0.58%	-0.84%	0.45%
Greece		6.71%	0.16%	-8.37%	4.84%	0.11%	0.69%
Hungary			0.56%	-1.15%	-3.36%	-3.26%	-1.80%
Iceland		3.20%	3.72%	2.27%	3.71%	1.93%	2.96%
Ireland		-0.31%	-1.64%	2.00%	-4.70%	1.81%	-0.57%
Italy		0.99%	0.95%	0.57%	0.16%	-0.55%	0.42%
Latvia					-1.84%	-2.33%	-2.09%
Lithuania			1.88%	0.63%	2.57%	2.97%	2.01%
Netherlands			2.55%	2.24%	2.80%	2.00%	2.40%
Norway	2.10%	-0.61%	3.10%	3.91%	0.54%	0.82%	1.64%
Poland			0.78%	-0.21%	0.50%	-0.35%	0.18%
Portugal		-3.01%	-4.98%	0.53%	7.80%	5.47%	1.16%
Romania						3.66%	3.66%
Slovakia			2.58%	3.47%	0.80%	0.27%	1.78%
Slovenia			0.53%	-0.33%	-1.33%	-1.45%	-0.65%
Spain		-0.43%	-1.05%	-0.39%	-0.15%	0.62%	-0.28%
Sweden		1.08%	-0.31%	-1.42%	-1.55%	2.43%	0.05%
United Kingdom			-0.27%	0.84%	-3.15%	2.49%	-0.02%
Weighted Average			0.55%	0.17%	0.06%	0.53%	0.33%
Simple Average			0.76%	0.54%	0.89%	1.05%	0.81%
Standard Deviation			0.018	0.024	0.031	0.029	0.025

Table 15. Output per student growth in the European countries. Extreme case 2, (%) per annum

Assumption: graduation does not matter

	2004	2005	2006	2007	2008	2009	Average
Austria		2.65%	2.83%	0.23%	2.97%	1.33%	2.00%
Belgium		0.37%	2.14%	0.11%	1.89%	5.42%	1.99%
Bulgaria						-0.48%	-0.48%
Cyprus			1.55%	4.49%	7.79%	9.70%	5.88%
Czech Republic			1.46%	2.00%	4.82%	3.25%	2.88%
Denmark	3.31%	4.52%	-1.15%	2.03%	0.43%	2.38%	1.92%
Estonia		3.43%	0.35%	0.11%	-1.56%	-0.38%	0.39%
Finland		1.31%	0.74%	0.06%	0.14%	-5.74%	-0.70%
France		2.18%	0.56%	-0.84%	-0.75%	-0.24%	0.18%
Germany			1.25%	0.67%	0.47%	-1.02%	0.34%
Greece		6.97%	0.35%	-8.30%	5.01%	0.18%	0.84%
Hungary			0.55%	-1.25%	-3.49%	-3.17%	-1.84%
Iceland		3.10%	3.78%	1.84%	3.98%	1.87%	2.91%
Ireland		-0.24%	-1.68%	1.98%	-4.44%	1.76%	-0.52%
Italy		0.99%	0.88%	0.51%	0.00%	-0.53%	0.37%
Latvia					-1.72%	-2.06%	-1.89%
Lithuania			1.90%	0.69%	2.66%	3.03%	2.07%
Luxembourg	1.42%	0.20%	1.43%	7.61%	8.09%	7.68%	4.41%
Netherlands			2.54%	2.20%	2.71%	2.07%	2.38%
Norway	1.97%	-0.49%	2.89%	3.74%	0.41%	1.02%	1.59%
Poland			1.11%	-0.03%	0.72%	-0.47%	0.33%
Portugal		-2.95%	-4.90%	0.65%	7.46%	5.33%	1.12%
Romania						3.73%	3.73%
Slovakia			2.91%	3.82%	0.84%	0.33%	1.97%
Slovenia			0.94%	0.22%	-0.91%	-1.17%	-0.23%
Spain		-0.27%	-1.07%	-0.41%	-0.14%	0.61%	-0.26%
Sweden		1.33%	-0.12%	-1.36%	-1.63%	2.33%	0.11%
United Kingdom			-0.81%	0.84%	-3.02%	2.59%	-0.10%
Weighted Average			0.51%	0.17%	0.07%	0.54%	0.32%
Simple Average			0.82%	0.86%	1.26%	1.41%	1.09%
Standard Deviation			0.018	0.028	0.034	0.032	0.017

5. Conclusions

This paper has considered the problem of measuring the output of the post-compulsory education. The approach, applied to the European countries over the period 2004-2009, combined data on enrolment with information on education outcomes such as earnings and employability. This allows us to obtain estimates of the rates of growth of the output of the sector. These estimates incorporate both implicit and explicit quality adjustments. Implicit adjustments are made through stratification distinguishing different levels of education.

Explicit adjustments are mainly included through different weights assigned to each output, those weights depending on their relative labour market outcomes.

A number of different estimates are obtained under different assumptions about the role of the probability of completing each level of education and the relevant probability of employment.

The results show that the quality adjusted estimates are significantly different from the apparent performance based only on data on pure enrolment. Using information on outcomes from education makes a difference which points to the convenience of employing this broader approach to measuring education output. The results from the method supply an enriched image of the true performance of the education sector and give additional information on its achievements, problems and shortcomings.

Therefore, the results obtained in this paper suggest that this is a promising method which ought to merit additional future efforts of improvement to complement the standard analyses based only on education data.

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